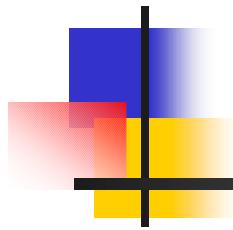
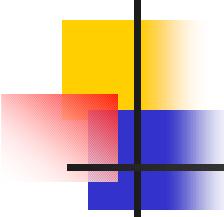


LQ search in eejj channel



Simona Rolli (TUFTS)



Introduction

- Some beyond the SM models assume additional symmetry between leptons and quarks
- LeptoQuarks – transition between leptons and quarks
 - Have both lepton and baryon numbers
 - λ - unknown coupling to leptons and quarks

LQ production at the TeVatron

■ Production

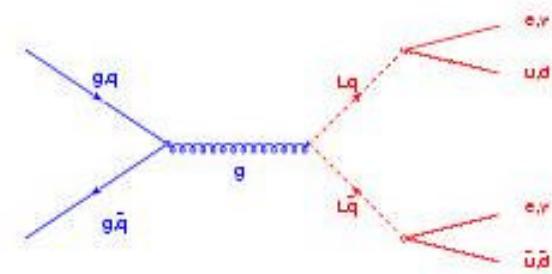
- $qg \rightarrow LQ + L\bar{Q}$
- $gg \rightarrow LQ + L\bar{Q}$
- $q\bar{q} \rightarrow LQ + L\bar{Q}$

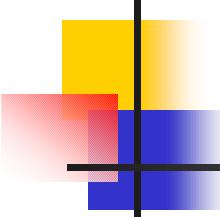
■ Decay

- $LQL\bar{Q} \rightarrow l^+l^-q\bar{q}, l^\pm n\bar{q}q, nn\bar{q}\bar{q}$ $\beta = \text{Br}(LQ \rightarrow eq)$

■ Experimental signature:

- High pt isolated leptons (and/or MET) + jets





LQ production at TeVatron

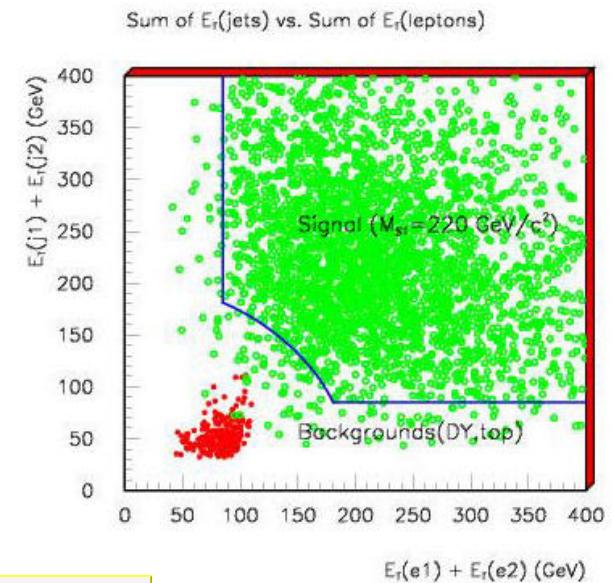
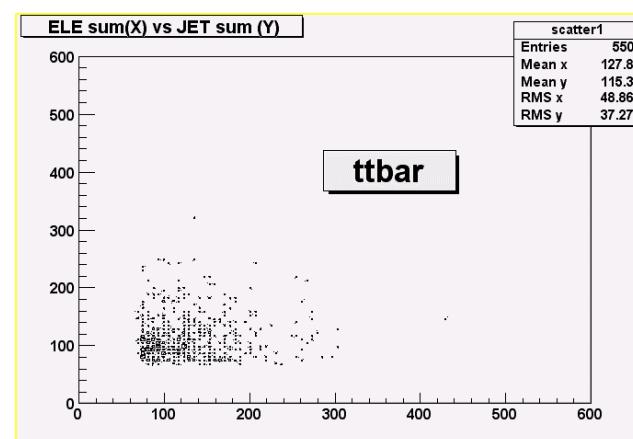
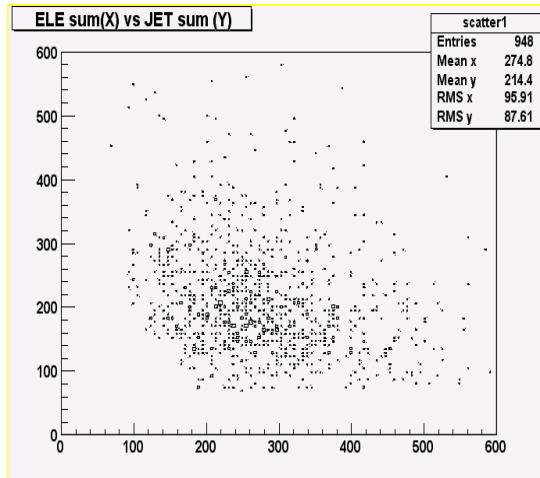
Code from Michael Kraemer (RAL-TR_97-033)

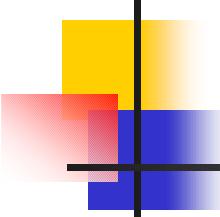
M_{LQ} (GeV/c ²)	σ (NLO) [pb]
200	0.265E+00
220	0.139E+00
240	0.749E-01
260	0.412E-01
280	0.229E-01
300	0.129E-01
320	0.727E-02

$\sqrt{s} = 1960$ GeV
 $Q^2 = M_{LQ}^2$
CTEQ4M pdf

LQ search in eejj

- 2 ele with $E_T > 25$ GeV
- 2 jets with $E_T(j1) > 30$ and $E_T(j2) > 15$ GeV
- removal of events with $76 < M_{ee} < 110$ GeV
- $E_T(j1) + E_T(j2) > 85$ GeV && $E_T(e1) + E_T(e2) > 85$ GeV
- $\sqrt{(E_T(j1) + E_T(j2))^2 + (E_T(e1) + E_T(e2))^2} > 200$ GeV

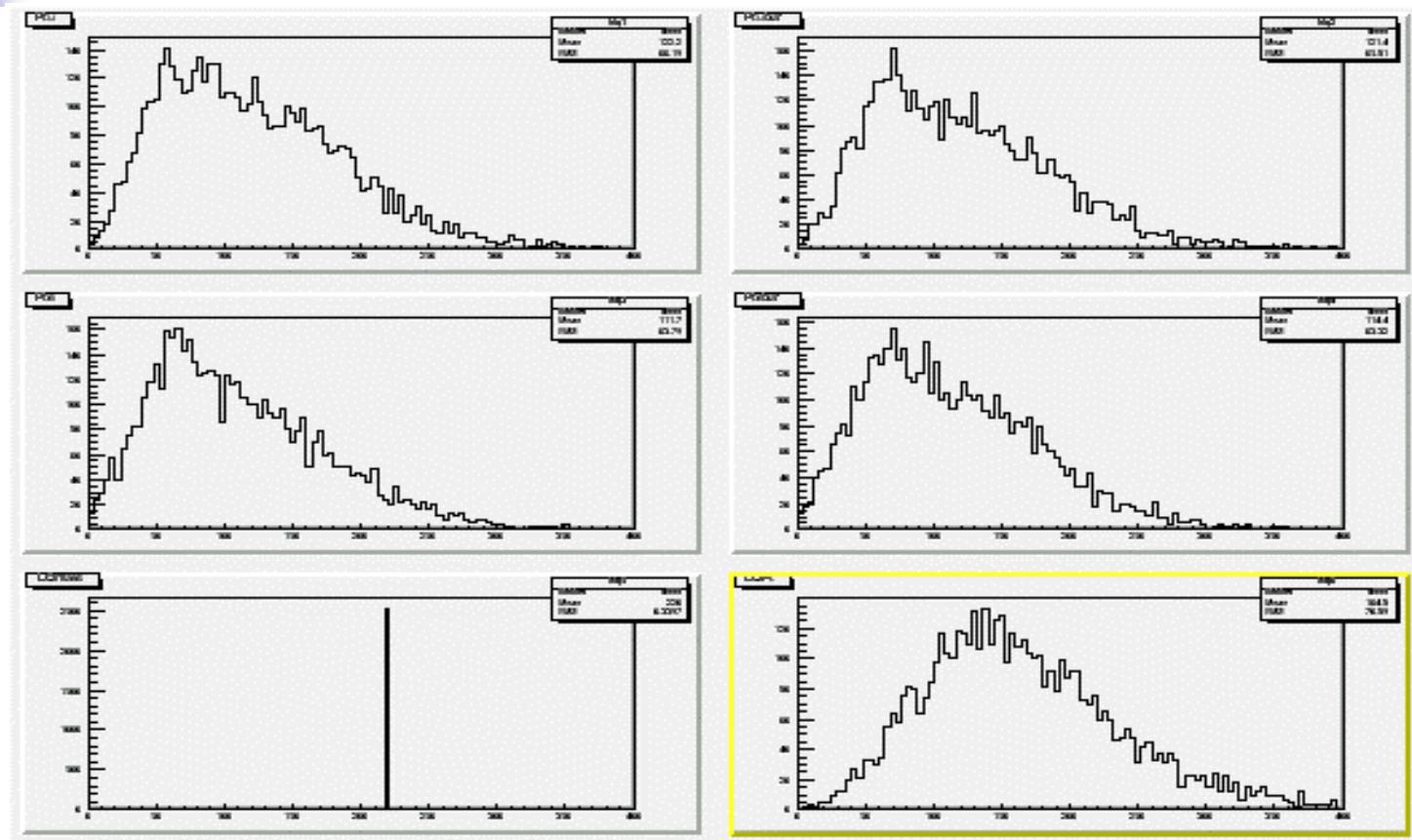




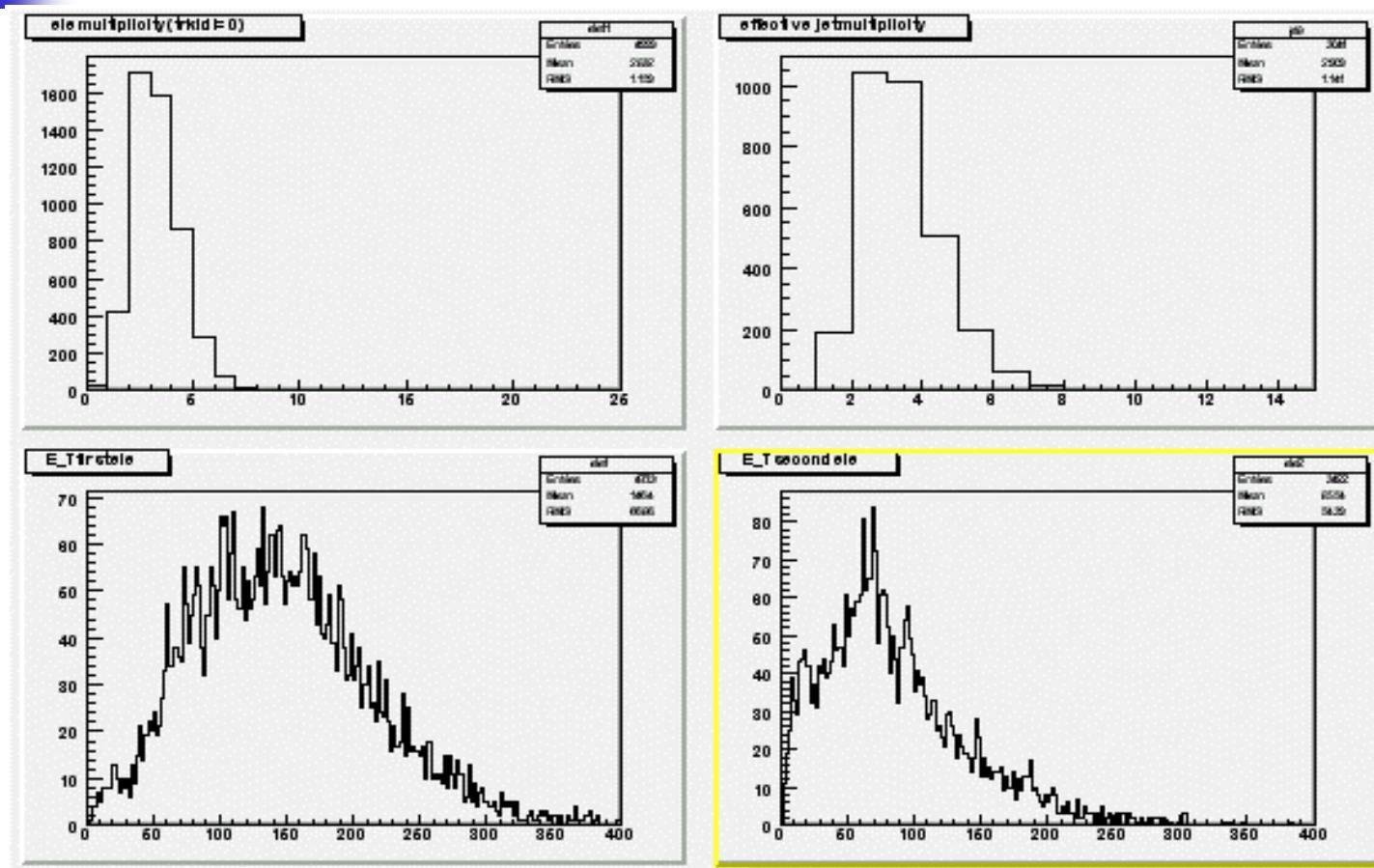
Tools

- Signal generated and reprocessed with 4.9.1
 - 5000 events at masses from 200 to 320
 - run number 151435
 - full beam position
 - talk GenPrimVert
 - BeamlineFromDB set false
 - sigma_x set 0.0025
 - sigma_y set 0.0025
 - sigma_z set 28.0
 - pv_central_x set -0.064
 - pv_central_y set 0.310
 - pv_central_z set 2.5
 - pv_slope_dxdz set -0.00021
 - pv_slope_dydz set 0.00031
 - exit
- eN (4.9.1)used for ntuple analysis
 - <http://ncdf70.fnal.gov:8001/talks/eN/eN.html>

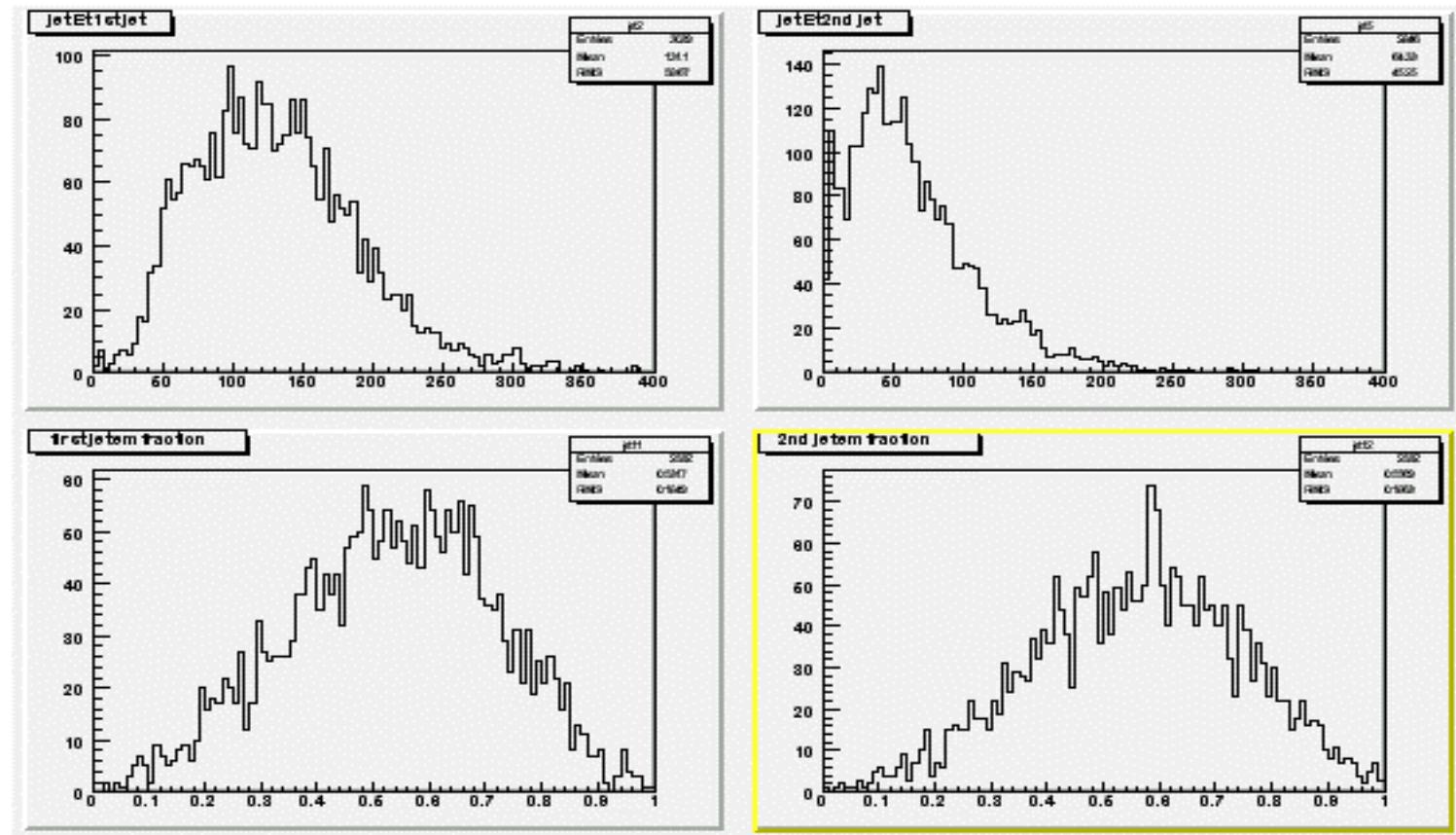
MC distributions ($M_{LQ} = 220$)

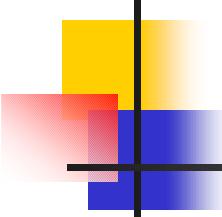


MC distributions ($m_{LQ} = 220$)



MC distributions (con'td)

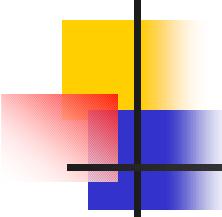




Efficiencies & acceptance

$$\epsilon_{\text{tot}} = \epsilon_{\text{Acc}}(M) \times \epsilon_{\text{ID}} \times \epsilon_{z0} \times \epsilon_{\text{trig}}$$

- Trigger
 - Top/EW - Z' analysis quotes $94.5 \pm 0.5\%$ (summer)
- Efficiencies for electron selection cuts
 - Z' analysis
 - possibly using new baseline cuts
- Other
 - efficiency on the vertex cut ($|z_0| < 60$ cm) $94.0 \pm 2.0\%$ (last summer value)



Electron ID (Z' analysis)

- Central electron (loose or tight)

- $E_t \geq 25 \text{ GeV}$
- $p_t > 13 \text{ GeV}$
- $\text{hadem} \leq 0.055 + 0.00045 * E$
- $E/p < 4$ (for $Pt < 50 \text{ GeV}$)
- $\text{iso4e}/\text{emet} < 0.1$ (0.2 for second central loose)
- $|\Delta x| < 3.0$
- $|\Delta z| < 5.0 \text{ cm}$
- Fiducial = 1

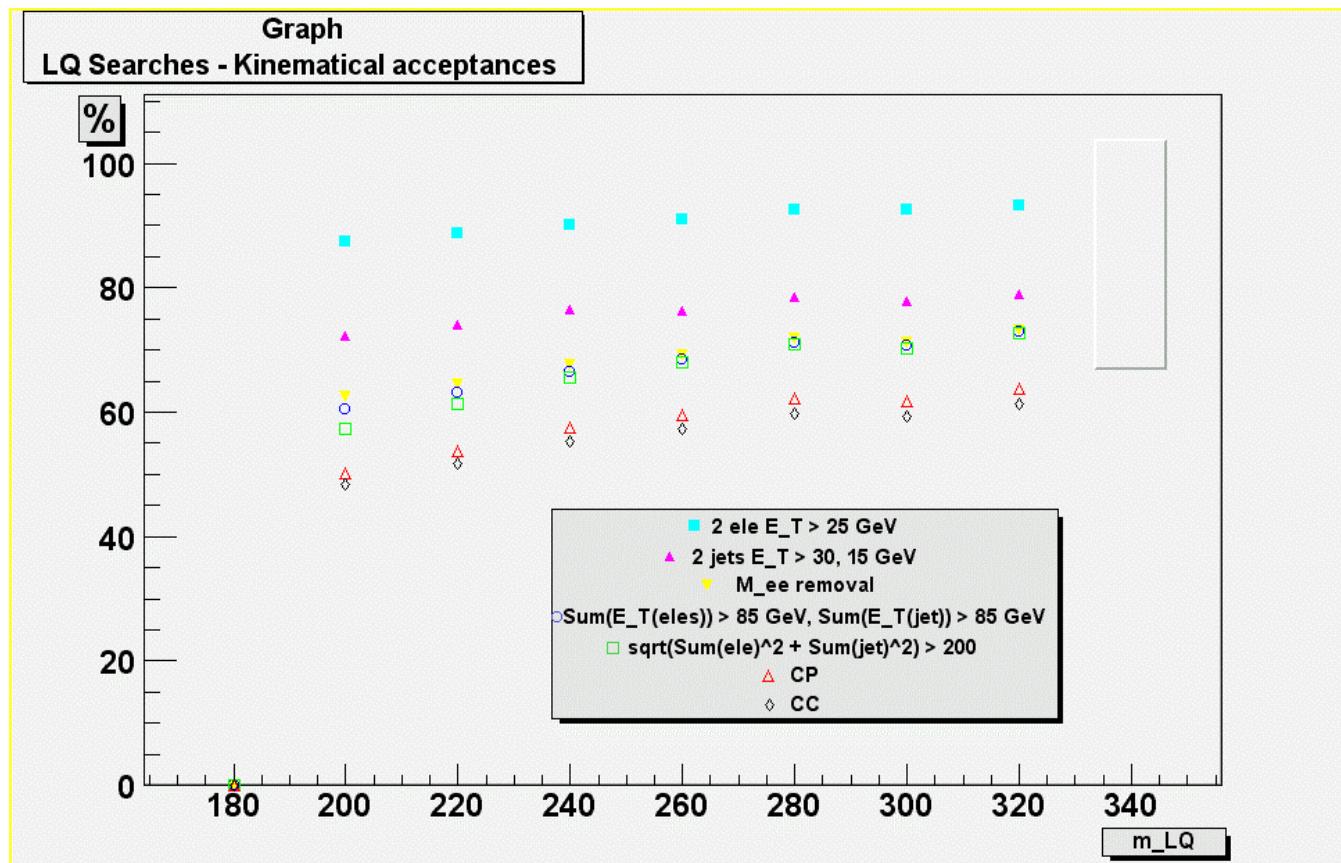
$$\epsilon_{CC} = 87.7 \pm 0.9\%$$

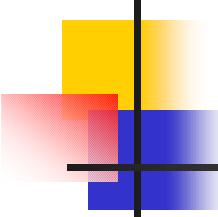
$$\epsilon_{CP} = 84.4 \pm 0.8\%$$

Second Loose ele plug

- $E_t \geq 25 \text{ GeV}$
- Isolation < 0.1
- $\text{hadem} \leq 0.055 + 0.00045 * E$
- Fiducial $1 < |\eta| < 3$

Total acceptance

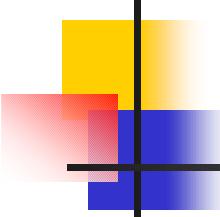




Total kinematical acceptance

M_{LQ} (GeV/c ²)	200	220	240	260	280	300	320
2 ele with $E_T > 25$ GeV	0.873±0.006	0.888±0.005	0.905±0.005	0.911±0.005	0.925±0.004	0.924±0.004	0.932 ±0.004
2 jets with $E_T > 30, 15$ GeV	0.723±0.008	0.740±0.007	0.768±0.008	0.763±0.007	0.785±0.007	0.777±0.007	0.790± 0.006
M_{ee} removal cut	0.625±0.009	0.644±0.008	0.685±0.008	0.690±0.008	0.712±0.008	0.711±0.008	0.731± 0.008
$\Sigma(E_T(\text{ele}_i)) > 70$ GeV & $\Sigma(E_T(\text{jet}_i)) > 70$ GeV	0.604±0.009	0.639±0.008	0.674±0.009	0.684±0.008	0.712±0.008	0.706±0.008	0.729± 0.008
$\Sigma(E_T(\text{ele}_i) + E_T(\text{jet}_i)) >$ 200	0.574±0.009	0.612±0.008	0.664±0.009	0.679±0.008	0.709±0.008	0.703±0.008	0.727± 0.008

	M_{LQ}	Exp(50 pb ⁻¹)	Exp (80 pn ⁻¹)
Number of	200	6.62	10.6
expected events	220	3.75	6.0
in 50 or 80 pb ⁻¹	240	2.18	3.5
(CC only)	260	1.23	1.96
	280	0.71	1.1
	300	0.4	.63
	320	0.23	.37



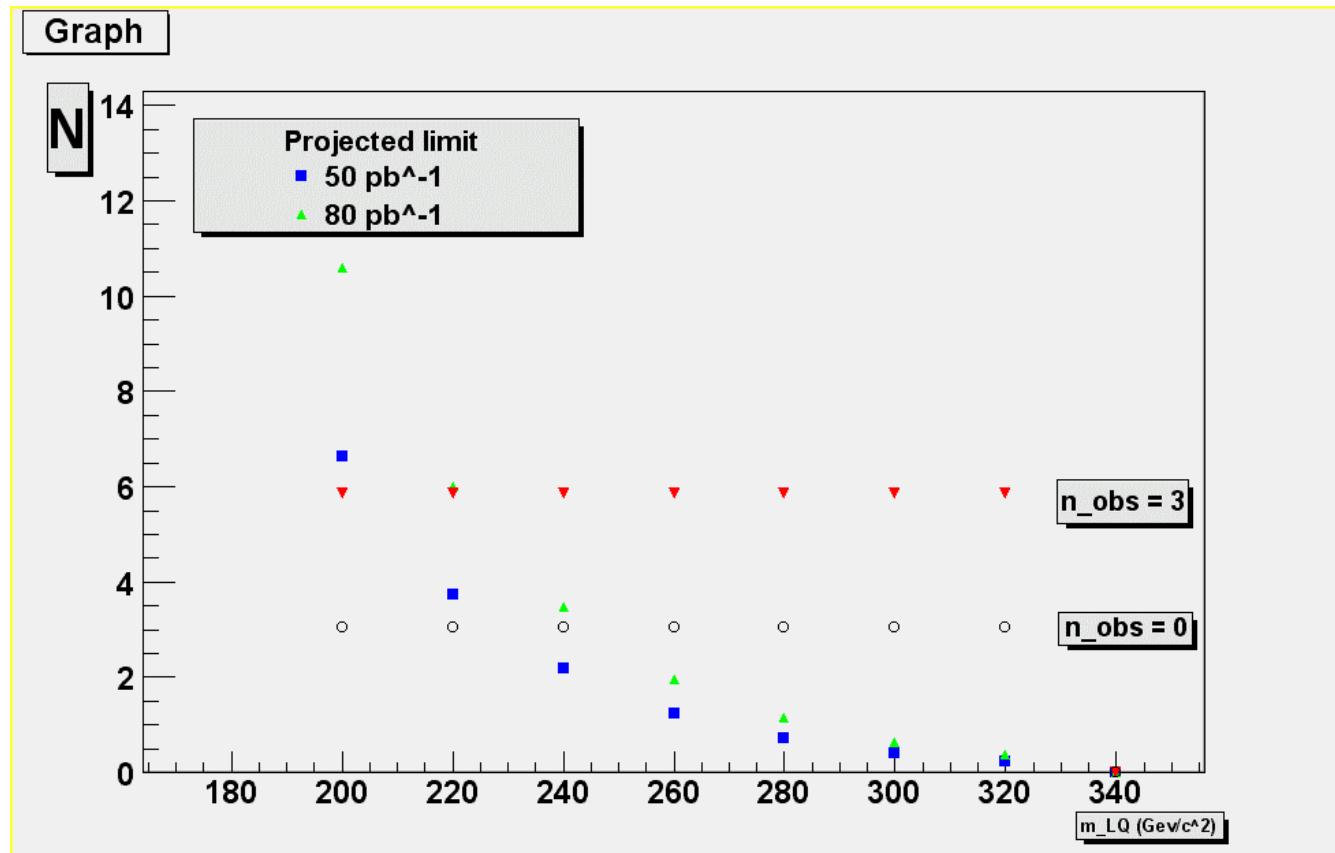
Background

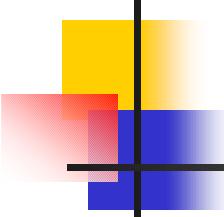
- tt with both $W \rightarrow e\nu$ 0.18 ± 0.02 (50pb^{-1})
 - pythia 0.20 ± 0.03 (80pb^{-1})

- DY + 2 jets 2.77 ± 0.9 (50 pb^{-1})
 - alpgen + PS 3.43 ± 0.9 (80 pb^{-1})

Projected Limit (CC only)

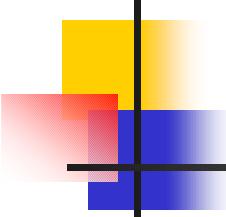
220 if
 $n_{\text{obs}} = 0$





Data sample

- btop0g (inclusive electrons) stripped from bheI08 and (4.8.4 Production)
- events selected from Ele_18 && Ele_70 triggers
- TrackRefitModule rerun from 4.9.1hpt1
- EmObject track pointers restored using UltimateChild()
 - 2 isolated electrons
 - One tight (central)
 - One loose (central or plug)
 - At least 2 energetic jets



Data sample

```
module clone Prereq HPTE
module enable Prereq-HPTE
module talk Prereq-HPTE
L1Accept set true
L2Accept set true
L3Accept set false
L3TriggerNames set ELECTRON70_L2_JET \
                 ELECTRON_CENTRAL_18 \
                 ELECTRON_CENTRAL_18_NO_L2 \
                 W_NOTRACK \
                 W_NOTRACK_NO_L2 \
                 Z_NOTRACK
debug set false
exit
exit
```

```
module clone StripSingleE HPE2
module enable StripSingleE-HPE2
module talk StripSingleE-HPE2
elePtMin set 15.0
etCalMin set 70.0
delXMin set 3.0
delZMin set 5.0
show
exit
```

```
module clone StripSingleE HPE1
module enable StripSingleE-HPE1
module talk StripSingleE-HPE1
elePtMin set 9.0
etCalMin set 18.0
delXMin set 3.0
delZMin set 5.0
EoPMax set 4.0
IshrMax set 0.3
hademMax set 0.125
show
```

Plans

- Looking at data
 - REMAKE inclusive electron sample
- systematics

1 st Gen.	β	Scalar (GeV/c)	Vector Minimal Coupling (GeV/c)	Vector Yang-Mills Coupling (GeV/c)
DZero	1	225(242)	292	345
	0.5	204	282	337
	0	98	238	298
CDF	1	220(242)	280	330
	0.5	202	265	310

25% increase in the cross section
 ~factor 1/3 less luminosity
 acceptances slightly higher

